



THE LORANTHACEAE OF AUSTRALIA. Part ii.

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(Plates xxvii.-xxxii.)

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Series **SANTALES** Lindl.Subser. **Loranthineae**.

(Engler, in Engl. et Prantl, Pflzfam., Nachtr., iii., 1897, 346.)

Family LORANTHACEAE D. Don.

Flowers regular hermaphrodite or unisexual. Calyx usually gamopetalous, sometimes wanting, when present the limb entire or toothed. Bracts usually one under each flower, free or fused to the pedicel, sometimes calyculate. Petals 2 to 6, valvate in bud, free or united into a lobed corolla inserted on the summit of the ovary. Stamens as many as petals, opposite to and inserted on them or in the centre of the flower; anthers sessile, versatile, or adnate, 2-celled, opening by pores or longitudinally. Disc usually present though not conspicuous, annular, or somewhat pentagonal. Ovary inferior, 1-celled, with 1 erect or semi-erect ovule. Style simple; stigma small, awl-shaped, or more frequently subcapitate. Fruit baccate or tripterous, crowned by the small disc and the persistent calyx lobes or petals, one-seeded, the seed adherent to the pulp of the pericarp, and surrounded by viscin, endosperm albuminous. Embryo clavate or cylindrical, the radicle superior, cotyledons 2-5, often remaining within the endosperm when germination takes place. Shrubs or trees with brittle, jointed branches, parasitic on the branches and roots of other plants. Leaves simple entire, with "stone cells all through the mesophyll; these are often star-shaped with long slender arms," * opposite or alternate, usually thick and coriaceous, tri- or quinque-nerved, or penninerved, sometimes reduced to minute scales or wanting, when absent the branches markedly compressed and viridulus. Stipules when present, small and persistent. Inflorescence cymose, racemose, capitate or fasciated; flowers conspicuous or minute, highly coloured or pale green.

"The only internal *secretory organs* found in this Order are mucilage-canals, which occur in *Nuytsia floribunda* R.Br. They appear in the pith and in the later stages in the bast; the pith contains a central mucilage-canal, and others

* A. G. Hamilton in Brit. Ass. Adv. of Sci., N.S.W. Handb. 1914, 402.

which are peripheral, and situated opposite the largest vascular bundles. The peripheral canals pass into the midrib of the leaf with the vascular bundles, retaining their position on the upper side of the latter; they do not appear to undergo any further branching; but become considerably swollen at certain points. The mucilage-canals of *Nuytsia* are provided with an epithelium of several layers, but are nevertheless of lysigenous origin; in the leaf the middle lamellae of the gelatinized cells, which form the canal, can still be clearly recognised." †

KEY TO THE SUBFAMILIES AND TRIBES.

(A). Receptacle with "Calyculus," or a calyx-like outgrowth surrounding the base of the perianth. Perianth double. Flowers bisexual. Filaments conspicuous; anthers adnate or versatile, two-celled, the cells opening longitudinally. Fruit with a central layer of viscin surrounding the endosperm.

Subfam. I. LORANTHOIDEAE.

Stems with mucilage canals in the pith, and in the latter stages in the bast. Calyculus rudimentary. Fruit dry, tripterous; endosperm soft, albuminous. Viscin layer thin. Terrestrial root-parasitic shrubs or trees 1. NUYTSIEAE

Stems without mucilage canals. Bast only outside of the wood. Calyculus more or less developed. Fruit berry-like or like a stone-fruit. 2. LORANTHEAE.

Ovary one or more celled (one-celled in all the Australian genera); embryo sac only on fertilization pressing right up to the base of the style. Fruit drupaceous. Endosperm horny, deeply cleft. Viscin scanty. Terrestrial? non-root-parasitic shrubs. 2a. GAIADENDRINAE.

Perfect ovary one-celled; embryo sac pressing up towards the base of the style. Endosperm soft, albuminous, smooth, or with faint longitudinal depressions. Viscin copious. Semi-parasitic shrubs. 2b. LORANTHINAE.

(B). Receptacle without "Calyculus," or a calyx-like outgrowth surrounding the base of the perianth, or the perianth single. Flowers always unisexual. Anthers sessile or nearly so, with three or numerous pollen-bearing chambers, dehiscent by pores. Fruit with a sticky central layer. Seeds compressed in all the Australian species. Subfam. II. VISCOIDEAE.

Placenta central. Anthers imperfectly 2-celled or dehiscent by a terminal orifice. Perianth 3-merous. 1. KORTHALSELLINEAE.

Placenta basal. Anthers adnate to the petals, many chambered, dehiscent by pores. Perianth 2-4-merous. 2a. VISCEAE.

I. 1. LORANTHOIDEAE-NUYTSIEAE.

Engler in Engl. et Prantl, Pflanzenfam., iii., i., 1889, 177, et Nachtr., iii., 1897, 124.—*Euloranthae* Benth., in Bth. et Hook. f., Gen. Pl., iii., 1880, 205.

Calyculus rudimentary, shortly triquetrous. Fruit tripterous. Ovary 1-celled. Cotyledons 2-4. Endocarp soft, not furrowed. Xylem with bands of soft bast, traversed by concentric layers of thin-walled tissue, which consists chiefly of parenchymatous cells and includes mucilage-canals, also small groups of soft bast.

1. NUYTSIA R.Br.

Journ. Geogr. Soc., i., 1831, 17; Benth., B.Fl., iii., 1866, 387.

Flowers bisexual. Perianth double. Calyx shortly winged, the tube adnate to the ovary; the limb short, irregularly 6-toothed. Petals 6, linear, free, erect or spreading. Stamens as many as petals, inserted on the lower half of the

† Solereder, Systematic Anatomy of the Dicotyledons, ii., 1908, p. 728.

petals; filaments slender, compressed. Anthers ovate-oblong, versatile with parallel cells, opening longitudinally. Ovary inferior, 1-celled. Style elongated subulate; stigma small, scarcely perceptible. Fruit a dry, scarious, tripterous, one-seeded nut $\frac{1}{2}$ to $\frac{3}{4}$ inch long, and about as broad; seeds trigonous. Embryo clavate, surrounded by copious albumen, with 1 to 4, usually 3, unequal cotyledons. Terrestrial, root-parasitic, glabrous shrubs or trees; leaves alternate, opposite or in irregular whorls, linear, acute or obtuse, thick, one-nerved. Inflorescence racemose, terminal. Flowers orange-yellow, sessile, ternately arranged on the semifoliaceous, ternate, bracteate pedicels. The genus is limited to a single species endemic in Western Australia, and is named in honour of Peter Nuyts, a celebrated Dutch navigator, who discovered that part of Western Australia formerly known as Nuytsland.

NUYTSIA FLORIBUNDA R.Br. (Plate xxvii.)

(Syn. *Loranthus floribundus* Labill.)

Journ. Geog. Soc., i., 1831, 17; Bot. Works., i., 1832, 308; Benth., B.Fl., iii., 389.

Medium-sized trees or shrubs, growing singly or in clumps, 20-40 feet high, 1-3 feet in diameter; timber pale, soft and spongy; branches thick; bark dark grey or lead-coloured. Leaves dark green, sometimes glaucous, opposite, alternate or in irregular whorls of 3, narrow linear, acute or obtuse, narrow-oblong, shortly petiolate or sessile, 1-3 inches long, thick, nerveless, or with a central nerve, and numerous fine longitudinal wrinkles when dry. Inflorescence terminal, racemose, from a few inches to more than 1 foot long; pedicels angular or semi-terete, 10 to 15 mm. long, with 3, rarely 4 broad lanceolate or cordate foliaceous bracts, 3-7 mm. long (when in flower), supporting 3, sometimes 4 flowers. Flowers orange-yellow, sessile, with a small deciduous bracteole under each flower in addition to the three outer bracts. The central bract narrow, considerably longer than the lateral ones, all of which enlarge under the fruit to a length of 30 mm. and are markedly like those of *Loranthus grandibracteus* F.v.M. Not only do they enlarge, but they are of nearly equal length, with a conspicuous nerve down the centre. Buds cylindrical or slightly clavate, about 15 mm. long: the central one often larger than the others, usually developing first. Calyx triquetrous, 3-4 mm. long when the flower expands, the limb conspicuous, tridentate or irregularly toothed, enlarging with the fruit. Petals 6, cleft to the base into narrow linear segments. Filaments attached to the lower half of the petals. Anthers versatile, oblong, emarginate, 2 mm. long. Style straight, angular or slightly compressed, on a rather broad base; stigma small, acute. Fruit light to dark brown, broadly 3-winged, 20-30 mm. broad, and nearly as long, somewhat like fruits of *Dodonaea viscosa* or *D. triquetra*. Seeds trigonous, surrounded by a thin coating of viscin as in *Phrygilanthus* or *Loranthus*, 5-8 mm. long, 3-5 mm. broad. Endosperm albuminous, with a nutty flavour. Cotyledons 2-5, linear, subterete, acicular, unequal.

Mr. J. J. Fletcher (These Proceedings, xxxiii., 1908, 881) contends "that there is evidently the dominant number of cotyledons in *Nuytsia*." He also draws attention to the close relationship of this plant to *Persoonia* in its polycotyledonary characters, and illustrates his points with a number of interesting photographs. J. Drummond (Hooker's Jour. Bot., ii., 1840, 346), says the seeds resemble "Rhubarb" and that they vegetate with several cotyledons like the Pine.

As far back as 1841 M.H. (J.C.) Bidwill (Ann. Mag. Nat. Hist., viii., 1842, 438) draws attention to a plant of *Nuytsia* which flowered every year in the Government Botanic Gardens, Sydney, and at the same time pointed out that the seeds germinated with 3 awl-shaped cotyledons. The same plant was also referred to by Allan Cunningham (*op. cit.*, 439) as being "on the verge of a splendid flowering. It was brought from Western Australia by Baxter." Mr. J. H. Maiden informed me that he remembered the plant. It died in 1883.

Twenty years later the following reference to this plant appeared (N.S.W. Hort. Mag., iv., 1867, 23): "We believe it is somewhat over twenty years since the plant was first introduced to the colony, and various attempts have been made to propagate it, but without success; so that should the plant cease to exist, it will be a hopeless case to replace it." There is also a litho sketch by R. D. Fitzgerald.

Although the foliaceous floral bracts enclose 3 flowers, I have not seen them enclosing more than one ripe fruit. As the central flower appears to develop first, it is probably the fruit bearer, and the lateral ones are perhaps sterile. Whether this is so, I am not prepared to say without further field observations, or a supply of fruit in various stages of development. It is a matter which local botanists could look into with interest.

Mr. W. V. Fitzgerald (Mueller's Botanical Society, *l.c.*) supplies the following notes on its habit and reproduction: "Wood pale coloured, very soft and spongy, and of no commercial value. It exudes a white or pale-coloured gum, which in the fresh state is very adhesive. This remarkable and highly ornamental plant does not seem partial to any particular kind of soil, nor does it extend inland far distant from the coast. The flowers are produced during December, attaining their greatest perfection about the end of that month, hence the origin of the vernacular name of "Christmas Tree."

"According to Dr. Freiss, who collected specimens near Perth in 1838, it was termed by the colonists "Cabbage-tree." The radical portion of the stem thickens considerably immediately below the surface of the ground and often throws up white scaly shoots which, gradually ascending to the surface, develop into new plants. The roots are few, very watery and spongy. The species is reputed difficult of reproduction, but I have seen numerous seeds that have germinated after they had fallen on the surface of the ground and then perished, evidently from the effects of the direct rays of the sun; therefore it is apparent that the reproduction of the species from properly opened seed should not be attended with any great difficulty. Reproduction by means of the stolonlike shoots should be attended with reasonable success."

According to James Britten (Jour. Bot., xlvii., 1909, p. 143) *Nuytsia floribunda* is figured by Ferdinand Bauer in his drawings of Australian plants. Bauer collaborated with Robert Brown, and it is quite feasible that Bauer's detailed drawing of *Nuytsia* influenced Brown in segregating *Nuytsia* from *Loranthus*.

The anatomy of *Nuytsia*, also of *Loranthus* and *Viscum*, is dealt with by Solereder ("Systematic Anatomy of Dicotyledons," ii., 726-30, also Addenda, p. 1046). He also refers in his bibliography to Van Tieghem's contribution on the same subject (Bull. Soc. bot. de France, 1873, pp. 317-28).

O. H. Sargent (Annals Botany, xxxii., 1918, 216) contributes an interesting note on the fertilization of *Nuytsia*, and is inclined strongly to the opinion that birds are the "official" pollinators.

Range.—The *Nuytsia* appears to be confined to a limited coastal area in Western Australia. It extends from Bow River in the south, to the Murchison

River in the north. The following are the definite localities. Bow River ("Grows in damp places. Trees up to 30 ft. high and 2 ft. in diameter. Branches brittle and snap like carrots." S. W. Jackson, No. 997, Dec., 1912); Esperance Bay (Diels and Pritzel, Bot. Jahrb., 35, 1905, p. 175); Murray District (E. Pritzel, No. 139, Dec., 1901; in Bot. Jahrb., l.c.); Cannington (R. Helms, No. 996, 29-1-1899); Canning Plains (W. V. Fitzgerald, No. 1002, Jan., 1903); King George Sound (Robert Brown. Quoted by Benthams, B.Fl., iii., 389; B. T. Goodby, No. 312, Dec., 1901); Swan River (Drummond, 1st coll. Quoted by Benthams. Freiss, n. 1608 and others also quoted by Benthams); Perth (J. Sheath, No. 1001, Dec., 1910; Dr. J. B. Cleland; also photographs in the National Herbarium, Sydney, showing single-stemmed and Mallee-like plants, No. 999; Miss Moore, No. 1000); Woorloo (Max Koch, No. 1902, Dec., 1907); Coolgardie (L. Webster, No. 998, 1898); Murchison River (Oldfield, quoted by Benthams, l.c.).

Economic Uses.

Nuytsia often exudes a quantity of transparent gum which hardens on exposure to the air, and which is said to make a good adhesive mucilage (*vide* Maiden, Useful Native Plants of Australia, 219; also Fitzgerald, Muell. Bot. Soc., l.c.).

Host Plants.

Mr. D. A. Herbert has recently (Journ. Proc. Roy. Soc. W.A., v., 1918-19, 72), contributed an important paper on the structure, parasitism, etc., of this plant, in which the following host plants are given, which I have arranged in botanical sequence.

Gramineae: *Cynodon dactylon* Rich. Proteaceae: *Banksia attenuata* R.Br., *B. Menziesii* R.Br., *Stirlingia latifolia* Steud. Polygonaceae: *Rumex acetosella* L. Rosaceae: *Rosa* sp. Leguminosae: *Acacia pulchella* R.Br., *Jacksonia furcellata* DC., *Cytisus proliferus* L. var. *alba* (Tree Lucerne), *Vicia Faba* L. (Broad Bean). Geraniaceae: *Geranium* sp. Rutaceae: *Citrus* sp. Vitaceae: *Vitis* sp. Dilleniaceae: *Hibbertia hypercoides* Benth. Myrtaceae: *Melaleuca Hugelii* Endl., *M. viminea* Lindl., *Calythrix flavescens* A. Cunn. Umbelliferae: *Daucus Carota* L. (Carrot). Epacridaceae: *Conostephium pendulum* Deless. Solanaceae: *Solanum* sp.

I. 2a. LORANTHOIDEAE-LORANTHEAE-GAIADENDRINAE.

Engl., l.c., Nachtr., p. 125.—*Gaiadendrees*, van Tiegh., Bull. Soc. bot. France, xliii., 1896, 455.

Calyculus distinct. Ovary one- or more celled. Embryo elavate; cotyledons

2. Endosperm stone-like, deeply cleft.

2. GAIADENDRON G. Don.

Gen. Hist., iii., 1834, 431; Engler et Prantl, Pflanzenfam., iii., 177, and Nachtr., iii., 1897, 125; Benth. and Hook. f., Gen. Pl., iii., 212.—(*Gaiodendron*) *Gaidendron*, Endl., Gen., 1839, 801.—*Gaidendron*, Endl., Euchir., 1841, 399.

Calyx 6-8 toothed. Petals 6-8, narrow, free. Stamens 6-8, inserted on the petals. Style angular, subulate; stigma simple. Ovarium oblong-cylindrical. Fruit a drupe, endocarp hard, with 8 longitudinal ribs protruding into as many

deep furrows of the seed. Terrestrial shrubs with opposite, lanceolate leaves, and axillary racemes of creamy white flowers.

Like *Nuytsia*, this genus is represented in Australia by one species only, but there are six representatives in Colombia and Chili, which, however, belong to a different section, *Eugaiadendron* Engler, distinguished from the Australian section, *Atkinsonia*, by the ternate disposition of the inflorescence.

Sect. ATKINSONIA (F. v. M.) Engler.

Flowers in simple racemes of 3-8 flowers.

GAIADEUDRON LIGUSTRINA (A. Cunn.) Engler. (Plate xxviii.).

Engler, *l.c.*; G. Don, *l.c.*; Lindl., Swan River App., Bot. Mag., 1839, p. xxxix. (as *Nuytsia ligustrina* A. Cunn.); Veg. King, 1847, p. 791; Muell., *Fragm.*, ii., 1860-61, 130 (as *N. ligustrina*); *Fragm.*, v., 1865-66, 34 (as *Atkinsonia ligustrina*); Benth., B. Fl., iii., 1866, 388; Mart., Fl. Braz., 1868, p. 21; Etting., Über die Blatts. der Lor., Taf. xii., fig. 6-8 (*Nuytsia* sp.); Hook. Leon. Pl., 13, 1880-82, fig. 1319 (as *Loranthus Atkinsonae*); Benth. and Hook., Gen. Pl., iii., 1880, 212; Moore and Betehe, Handb. Fl. N.S.W., 1883, 228.

Terrestrial bushy shrubs, quite glabrous, 2 to 6 feet high, usually found in barren or rocky situations. Branches angular and somewhat striate, or the older ones echinate with the remains of the petioles. Leaves opposite (not alternate as stated by Bentham), narrow to broad lanceolate, or oblong lanceolate, scarcely acute, paler underneath, the margins recurved, midrib prominent, narrowed into a short petiole, 2-5 cm. long. Racemes axillary; the rhachis angular, 3-8 flowered, 1 to 2½ cm. long, shorter than the leaves, with three minute persistent acute stipules at the base. Flowers glabrous, single, opposite, on short thick pedicels, 3 mm. long. Bracts 3, decurrent on the pedicels and rhachis, unequal, the central one usually longer and broader than the lateral ones, occasionally all equal in length, narrow-linear or linear-lanceolate, 2-3 mm. long, enlarging under the fruit. Buds clavate, 5-8 mm. long. Calyx cylindric, 3 mm. long, the broad limb conspicuous, minutely irregularly denticulate. Petals 6 to 8, usually six, free, narrow-linear, acute, 6 mm. long. Filaments attached to the lower half of the petals, and about the same length as the anthers, usually with a small gland on the bent upper portion. Anthers versatile, lanceolate, 2.5 to 3 mm. long, and about 1 mm. broad. Style terete, considerably shorter than the petals, or well enclosed in the centre of the flower; stigma somewhat compressed. Fruit a hard drupe, ovoid to oblong, changing from scarlet to dark purple or nearly black when ripe, crowned with the persistent calyx limb, 10 to 13 mm. long, 8 mm. in diameter; epicarp very thin, coated with a thin layer of viscin; endosperm albuminous, deeply furrowed nearly to the centre into 7 or 8 divisions. Embryo oblique, suspended by a capillary suspensor, 1 mm. long, the suspensor slightly longer; embryonic cotyledons two, acute, unequal.

SYNONYMS.—*Nuytsia ligustrina* A. Cunn., *Loranthus epigaeus* F. v. M. (Coll.), *Loranthus Atkinsonae* Benth. and Hook., *Atkinsonia ligustrina* (F. v. M.) Benth.

Remarks.—The seeds of *Loranthus Exocarpi* Behr., show affinity to the fruits of *Gaiadendron ligustrina* in the somewhat deeply furrowed endosperm.

The leaves figured by Ettingshausen (Über die Blatts. der Lor., *l.c.*) under *Nuytsia* sp. are without doubt *Gaiadendron ligustrina*.

Range.—This plant is so far confined to a small area on the Blue Mountains, as the following localities will show, but it is less common now than formerly owing to the rapidly increasing population.

Mueller (Report Burdekin Expedition, p. 12) mentions that it is "said to be found also on the north-western tributaries of the Darling." I have been unable to confirm this statement.

Springwood (H. Deane), Woodford (J. H. Maiden), Linden (J. H. Maiden and R. H. Cambage. Mr. Maiden informed me that he had often seen this plant in open forest), Lawson (Reader, A. A. Hamilton), Wentworth Falls (H. Deane), "On the side of the road to Mt. Wilson about 1½ miles from Bell Railway Station" (A. A. Hamilton, These Proceedings, xxxix., 1915, 409), about 100 yards west of the second danger post on the Mt. Wilson road (W. F. Blakely), Mount Wilson (J. Gregson, J. H. Maiden, A. G. Hamilton, These Proceedings, xxiv., 1889, 359), Mt. Tomah ["I was pleased also to meet at Mt. Tomah, with a plant which you probably have in your herbarium, under the name of *Loranthus*, but it is terrestrial and although I unfortunately neglected to put specimens of its flowers into spirits as I should have done, still I trust those I send will suffice to determine the question, whether or not it should form with *L. floribundus* of La Billardière the genus *Nuytsia* of Robert Brown. We brought home a growing specimen with us, which appears likely to succeed in the Botanic Gardens (Sydney)."] R. Cunningham in a letter to the Editor, Botanical Magazine, Jan. 25th, 1835, *vide* Companion to Botanical Magazine, 1836, p. 218.], Mt. Tomah and Wheeny Creek (W. Woolls and L. Atkinson, quoted by Mueller in *Fragm.*, v., 34. Probably the type locality), About 2½ miles north-east of Marrangaroo Railway Station (Flowers light to dark orange colour; the most westerly locality, Dr. E. C. Chisholm and W. F. Blakely).

There is also a specimen in the National Herbarium, collected by Dr. Leichhardt without locality.

Is Gaiaendron ligustrina root parasitic?

The late Mr. E. Betehe investigated the supposed root parasitism of this plant, and collected a number of the roots which he preserved in alcohol. The Museum Register in the National Herbarium, Sydney, contains the following record relating to the roots, which is in Mr. Betehe's handwriting: "In about 1890, I was sent by Mr. Moore to get specimens of the roots for Baron von Mueller, and to report whether it is a parasite or not. I collected the roots of (Atkinsonia) *Gaiaendron* in all sizes, the thick roots, the small fibre roots, and the saprophytic roots growing upwards into the humus."

Mr. Betehe's report is not available but, judging from the record just quoted, his investigation gave a negative result. I examined these roots carefully and found the roots of a Myrtaceous plant amongst them, also the roots of another unknown plant. On making this discovery I decided to examine the plant in the field. Eventually I investigated several plants on the Mt. Wilson Road, and failed to find the slightest sign of parasitism, although the opportunity for such was very favourable. The plants were growing at the base of two trees of *Eucalyptus Sieberiana*, with which the roots of *Boronia microphylla*, *Eriostemon obovatis* and *Xanthosia pilosa* commingled. The soil consisted of fairly deep yellow sand with a little surface humus. The largest and apparently the oldest plant was growing between the two Eucalypts, its roots had grown across those of the Eucalypt, and some were also parallel with the roots of the latter, but no trace of parasitism was noticeable.

Young plants in the seedling stage with the endosperm attached to them were also found to be entirely dependent upon their own roots, which consisted of a deep radicle, and very fine lateral rootlets. Root hairs were abundant on the small roots. A three- or four-year-old plant was also carefully investigated and gave the same result.

The large roots, which vary from $\frac{1}{2}$ to 1 inch in thickness, are markedly soft and pliable and grow to a length of 3-6 feet. When cut, the sap turns blue-black in colour; the cortex is also very thick for the size of the root. The young roots are yellowish but with age they change to a brownish pink.

There is a general belief that the plant is stoloniferous. Those investigated by me showed no sign of stolons, for they were inclined to penetrate deeply into the soil. On the other hand, the plant vegetates freely from the crown and also from the main stem three or four inches under the ground, which very largely accounts for its shrubby habit. When burnt over by bush fires it sends up a new crop of shoots from the old stem, similar to the Waratah, but on a much smaller scale.

The plant should be easily propagated from seed and also from cuttings.

I. 2b. LORANTHOIDEAE-LORANTHEAE-LORANTHINAE.

Engler in Engl. et Prantl, Pflanzenfam., Nachtr., iii., 1897, 125 and 127.

Calyculus developed, though very small. Fetals free or united. Ovary 1-celled. Endosperm smooth or imperfectly canaliculate. Viscin copious. Anthers adnate or versatile.

(A). Filaments subterete, attenuated, subulate and often geniculate. Anthers versatile. 3. *Phrygilanthus*
(B). Filaments compressed, uniform, usually passing imperceptibly into the adnate anthers. 4. *Loranthus*.

Eichler (Martius, Flora Brasiliensis, v., 2, 1868, p. 45-48) was the first to separate the versatile section of our *Loranthaceae* from the genus *Loranthus* and establish the genus *Phrygilanthus*, in which he included *P. celastroides*, *P. Bidwillii* and *P. myrtifolia*, all of which were placed under *Loranthus* by Bentham and others. Subsequently, Bentham and Hooker (Genera Plantarum, iii., 211) recognised *Phrygilanthus* as a sub-genus of *Loranthus*, and furnished a brief description accordingly.

The National Herbarium, Sydney, is indebted to Mr. James R. Weir, Forest Pathologist-in-Charge, Bureau of Plant Industry, Department of Agriculture, Washington, for the description of the genus *Phrygilanthus*, which is now produced, as not readily available.

PHRYGILANTHUS Eichler.

Fl. Brazil., v., 2, 1868, 24.—§§ *Loranthi Oscillantherae Tetramerae et Taguanae* DC., Prodr., iv., 307, 315.—*Teisterix* ex parte et *Struthanthi* species, Mart., Flora, 4, 1830, 104, 108.—*Gaiadendron*, *Notanthera* et ex aliis generibus species, Don, Gen. Syst., iii., 128, 431, etc.—*Loranthi* §§ 6. et 4 (ex parte), Oliv., Journ. Linn. Soc. London, vii., 98.—*Loranthi* spec. Auct., *Epicoila* Raf., Sylva Tellur., 1838, 126; *Taguaria*, Raf., ibid., 125.—*Loranthus*, Benth. and Hook. f., Gen. Pl., iii., 212; Engl. et Prantl, iii., i., 178, and Nachtr., 133.

Flores hermaphroditi, solemniter 6- (3+3-) meri, rarius 5-v. 4-nune 7-8-meri. Calyx ureolatus v. marginiformis, integer v. dentatus. Petala libera, in corollam regularem conspirantia, alternatim apice latiora et obtusiora, angustiora

et acutiora, rarius (in quibusdam 4- et 5-meris) aequalia. Stamina petalorum ratione aut aequalia aut diversa: longioribus altioribus solito more ante petala obtusa, brevioribus demissioribus ante aenta positis; Filamenta inferne petalo postposito adnata, superne libera cylindrico-filiformia, apice subulata, eum connectivo articulata; Antherae dorso plq. medio affixae, versatiles, ellipticae v. oblongae, biloculares, longitrorsum birimosae. Pollinis granula ut in *Psittacantho*. Ovarium cylindrico-subglobosum usque lineare, disco carnoso annuliformi integerrimo v. pro petalorum numero lobato tectum; Stylus cylindrico-filiformis, v. subulatus. Stigmata capitato v. punctiformi, rarius sub-bilobo. Bacea succosa, epicarpio carnoso, endocarpio plq. membranaceo, mesocarpio viscoso crasso totum semen involvente. Semen albuminosum; Endospermium aequabile (*Phr. aphyllus* et al.) aut plicis endocarpii ruminatum (*P. Tagua*), firme carnosum v. corneum; Embryo cylindricus, endospermii fere longitudine, Cauliculo plq. breviter exserto. Cotyledonibus 2 liberis semiteretibus applicativis.

Frutices super Dicotylearum ramos semiparasitici, rarius. Arbuseulae teretres autotrophae. Radices solemniter nonnisi intracorticales, rarissime aerea prehensiles. Caulis Ramique plq. teretes. Folia opposita decussata, saepe metapice disjecta, rarius per spiram $2/5$ v. affinem alterna, frondosa, ruro ad squamas reducta, utrinque stomatophora. Flores solitarii v. per ternationes in racemis corymbisre terminalibus et axillaribus (in una aedeo reductis, ut florem axillarem mentiantur, cf. infra n. 2); Bracteis Bracteolisque variis (cf. infra conspectum specierum), flore tamen ternationis intermedio nunquam cupula instructo, in lateralibus bracteolis secundariis constanter deficientibus. Flores inter majores, $\frac{1}{2}$ poll.- spithamaei, rubri flavi v. albi. Crescunt majore numero in topicis Americae australis, regionibus praecipue montosis Columbiae, Peruviae, Chile et in Brasilia subtropica; paucae in Australia occurrunt.

The following brief description covers the Australian representatives of the genus: Flowers bisexual, $\frac{1}{2}$ to $1\frac{1}{4}$ inch. long; calyx cylindric or pear-shaped, obscurely toothed or entire. Buds clavate; corolla straight or curved, on maturity readily separating to the base into 5, rarely 6 narrow-linear segments. Stamens as many as petals; filaments compressed or terete; anthers elliptic oblong, versatile; style filiform, terete or angular; stigma clavate or capitate. Fruit spherical, cylindrical or pear-shaped, 5 to 15 mm. long. Endosperm albuminous; embryo cylindric; embryonic cotyledons not withdrawn from the endosperm on germination. Primary leaves narrow lanceolate, broad spatulate to elliptical, 2, occasionally 3. Inflorescence sub-terminal, cymose or the flowers borne on very slender frutate peduncules. Flowers single or ternate, each supported by a small, navicular, persistent, pedicellate bract. Parasitic shrubs with numerous divaricate branches, and usually with conspicuous aerial roots. Leaves opposite, linear, spatulate, obovate to lanceolate-falcate. Differing from the Australian *Loranthus* mainly in the versatile anthers and terminal inflorescence.

The genus is represented by about thirty species, mainly from Brazil, Chili and Peru. New Zealand and the Philippine Islands have each one representative, while Australia has four.

Seet. MUELLERINA Engler.

Engl. and Prantl, Pflanzenfam., Nachtr., iii., 1897, 134; genus *Muellerina*, van Tiegh., Bull. Soc. bot. Fr., xlii., 1895, 25, 175.

Inflorescence cymose; flowers ternately arranged; the central flower sessile.

Leaves large.

1. Leaves narrow to broad lanceolate, often triplinerved, 5-16 cm. long. Pedicels and bracts glabrous. 1. *P. eucalyptifolius*.
 1°. Leaves obovate to elliptical, penninerved. Pedicels and bracts minutely pubescent. 2. *P. celastroides*.

Sect. *FURCILLA* Engler.

Engler and Prantl, *l.c.*; genus *Furcilla*, van Tiegh., *l.c.*, pp. 85, 166.

Inflorescence furcate; the common peduncle bearing 2 pedicellate flowers.

Leaves small

1. Leaves cordate, very thin, almost sessile, 1-2 cm. long. . . 3. *P. myrtifolia*.
 1°. Leaves linear, petiolate, 12-24 mm. long. 4. *P. Bidwillii*.

1. *PHRYGILANTHUS EUCALYPTIFOLIUS* (Sieh.) Engler. (Plate xxix.).

P. celastroides (Sieh.) Eichl. var. *eucalyptifolius* Engler (imp.), Nachtr., iii., 1897, 134; *L. eucalyptifolius*, Sieh. in Roem. et Schult., Syst. Veg., vii., 1829, 163, non H.B. et K.; G. Don, Gen. Hist. Pl., iii., 1834, 431; Miq., Ned. Kruidk. Arch., iv., 1856, 105; A. Gray, Bot. U.S. Exp. Exped., i., 1854, 741; F. Muell., Pl. Vic., t. 30 (fig. on right-hand side of plate); Ettingsh., Über die Blatts. der Lor., Tab. xiii., fig. 11 to 13, Tab. xiv., fig. 2; Muell., Key Vic. Pl., part ii. (lower figure of t. 66); Muell., Rept. Burdekin Exped., 13; Kunth., Bl. Biol., iii., i., 255, fig. 45; Engler and Prantl, Pflanzenfam., iii., 179 (as *P. celastroides* (Sieh.) Eichl.); Ewart, Weeds Poi. Pl. Vic., 28 (Fig. on right hand side of plate).

I have not seen Sieber's original description but presume that of De Candolle is a reproduction, which, translated by Don, is as follows: "Glabrous; branches terete, dichotomous; leaves opposite, petiolate, lanceolate-linear, acutish, thick-coriaceous, almost veinless. *L. eucalyptifolius* Sieh. *Fl. Nov. Holl.* No. 242, but not of Kunth. Leaves 3-4 inches long and 6-7 lines broad. Petioles 6 lines long. Flowers and fruit unknown."

Asa Gray (Bot. Amer. Exp. Exped., *l.c.*) refers to this species in the following words: "Of this species as of *L. eucalyptoides* neither the flowers nor the fruits were known. They occur in our specimens, and are almost exactly like those of *L. celastroides*. Moreover some of the leaves, instead of being elongated-lanceolate and somewhat falcate, are elongated oblong, very obtuse and less than 2 inches in length; arising the question whether it may not be an extraordinary form of the foregoing species, *L. celastroides*."

I, however, maintain it is a valid species and give the following evidence in support of that view. The original description is very imperfect, and I therefore proceed to describe it more fully: Strictly glabrous plants (even the inflorescence and young parts); union supported by numerous adventitious roots, frequently exceeding the branches by several feet; branches pendulous, smooth, terete except for a slight compression at the nodes of the young branches; lenticular, with linear, transverse, often red-brown lenticles, 1-10 feet long, sometimes forming dense masses, but as a rule hang in graceful showers (depauperate plants with short, matted, semi-erect branches); internodes 2-10 cm. long. Leaves opposite, thick, coriaceous, 5-20 cm. long, 1-3 cm. broad, somewhat shining when green, dull when dry, usually broad linear to narrow lanceolate, acuminate or falcate, occasionally long-spathulate, tapering at the base into a terete curved

petiole, $\frac{1}{2}$ -1 $\frac{3}{4}$ cm. long (abbreviated forms often oblong obtuse to broad lanceolate); venation scantily penninerved or obscurely triplinerved at a distance from the base, the intermediate nerves rarely reaching the apex. In the narrow-leaved forms the midrib is alone conspicuous. Sometimes the veins are short and scarcely parallel, and are more numerous on one side of the midrib than the other, but they are always at a much higher angle, and less reticulate than those of *P. celastroides*. Inflorescence a terminal shortly branched cyme, 1-4 ins. long, bearing 12-24 bracteate flowers. Flowers in triads, the central ones sessile, maturing first, usually larger and longer than the lateral ones; bracts glabrous, small, concave, ovate-elliptic, spreading when dry; calyx subcylindric, curved at the base like the bowl of a pipe; the slender 4-7 mm. pedicel acting as the stem (the curvature of the calyx is erratic, and often causes the flowers to turn in various directions); limb truncate, rarely toothed, paler than the base, the whole 5-7 mm. long; buds often abruptly curved at the base and again at the top, the apex acute, ventricose in the lower portion and in the vicinity of the anthers, 4-6 $\frac{1}{2}$ cm. long, marked by the unequal insertion of the filaments, slightly striate by the lines of demarcation of the perianth segments. Petals usually 5, occasionally 6 in the central flowers, or in luxuriant forms, free, linear-lanceolate, acute, reddish inside to the base of the filaments, yellowish-green, or occasionally shaded rose on the outside, deflexed or somewhat oblique, the two lowest cleft at least 5 mm. below the three upper ones, all minutely erenulate on the somewhat thickened inner margins at the base, but more conspicuous on the two lower petals, the top sometimes with a minute gland-like appendage inside above the filaments and a short distance from the extreme point. Filaments unequal in length, those attached to the upper petals longer than the others by 2-3 mm., and geniculate a short distance below the anthers, the longest with two rudimentary glands, the shorter ones with a single gland on the bent upper portion. Anthers versatile, oblong, 2-3 mm. long, about 1 mm. broad, minutely emarginate at both ends. Style pentagonal, usually green throughout, exceeding the anthers by about 3 mm., the upper portion geniculate or sometimes minutely flexuose, dotted with 4-8 minute glands; stigma minutely capitate or scarcely enlarged, reddish. Disc pentagonal, but not acutely so, pitted on the inside with five depressions or scars of the segments, and with a central pit or the remains of the style. Fruit usually curved, cylindric or pear-shaped, 10-15 mm. long, light green with a pale yellow top, opening semi-apically. Epicarp thick, coriaceous; viscin sae 7-12 mm. long, the spongy base globose; seeds turbinate with slightly raised angles at the top, surrounded by copious viscin, about 5 mm. long. Endosperm white; embryo elongated, terete, about 3 mm. long, green; the embryonic cotyledons narrow oblong, remaining in the endosperm when germination takes place; hypocotyl very short, scarcely 1 mm. long. On germination the hypocotyl, with the disc, resembles that of *Notothixos subaureus* Oliv. but, unlike the latter, it does not grow out from the seed in quest of a suitable spot for attachment, but turns abruptly under the seed or endosperm, and attaches itself to the host, as it were from the shelter of the seed which is thickly coated with very tenacious viscin, which hardens or liquefies according to the progress of the hypocotyl. Primary leaves narrow spatulate to lanceolate, developing to a length of 10 mm.

The seeds germinate very rapidly in favourable weather, on any object on which they chance to fall. An investigation showed that beneath a large fruiting plant of this species, the free germination of the seed was observed upon many objects, such as rocks, bones, blades of grass, leaves and gum of *Xanthorrhoea*

hastilis, and on dead wood and leaves lying on the ground. Although germination takes place, the young seedlings do not adapt themselves to all their hosts; in fact, none survived on the objects mentioned above, which demonstrates clearly that more favourable conditions are necessary for the reproduction of the species and if these are forthcoming, the rapid spread of the plant is inevitable.

Much confusion has resulted in placing (*L.*) *P. eucalyptifolius* (Sieb.) as a synonym of (*L.*) *P. celastroides* (Sieb.) by Benth. (*B.Fl., l.c.*). To those familiar with the two plants, Benth. decision, which no doubt was influenced by those of Mueller and Gray, has long been regarded as unsatisfactory. Mueller (Report Burdekin Expedition, 13) definitely states that "*L. eucalyptioides* DC. is, as suspected by Professor Asa Gray, referable to *L. celastroides*," and he afterwards figured both species (Plants of Victoria, i., Plate 30) as *Loranthus eucalyptioides* DC. The figure on the right hand side of Plate 30 is *P. eucalyptifolius* (Sieb.); that on the left is *P. celastroides* (Sieb.) Eichl. A glance at the plate will at once disclose the difference in the shape and venation of the leaves of these two species. The leaves of *P. eucalyptifolius* have the appearance of being uninerved or nerveless, and are considerably longer than those of *P. celastroides* which are short and broad, shortly petiolate and penninerved. In Mueller's "Key, Plants of Victoria," the species are again mixed; the lower figure of Tab. 66, is *P. eucalyptifolius* and the upper figure is *P. celastroides*.

A flowering branch of *P. eucalyptifolius* with a pair of depauperate leaves appears in Kunth (Bluten Biologie, viii., i., Fig. 45, 255) as *P. celastroides*, which is said to have been reproduced from Engler et Prantl, Pflanzenfam.; apparently Engler has followed Mueller in his "Plants of Victoria." The leaves figured by Ettingshausen (Über die Blattskelette der Loranthaceen, Tab. xiii., Figs. 11-13) are all deformed, and therefore, the venation is abnormal. In the case of imperfect or irregularly shaped leaves, the venation is rarely the same as in well developed or proportioned leaves. A rupture to the median nerve in its initial stages will greatly change its natural contour and, by the time the leaf reaches maturity, its effect is apparent throughout the whole system of venation.

Deformity in the leaves of the *Loranthaceae* is very common, and most species readily lend themselves to insectival disfiguration, and also to ecological conditions and, because of these characteristic anomalies, it is not difficult to match the diagrams already quoted with specimens that are almost fac-simile. On Tab. xix., Fig. 2 (Ettingshausen, *l.c.*) a more perfect leaf is depicted, which is distinctly triplinerved.

P. eucalyptifolius is more polymorphous than *P. celastroides*, apparently the result of environment rather than racial distinction. Many plants of this species are very frequently found with large thick oblong to obovate leaves, of which some are strongly veined and are suggestive of *P. celastroides*, but when closely examined the venation and texture are entirely different from those of *P. celastroides*. It is not uncommon to see two different kinds of leaves on the same plant; they are very often due to old and young plants growing together, or sometimes the result of seasonal growth.

Those who are familiar with the versatile section of our *Loranthaceae* will admit there is a great similarity in the flowers, and it is specially so with *Phrygilanthus eucalyptifolius* and *P. celastroides*. In the case of these two species, the venation of the leaves presents a sharp line of demarcation between them, and there are other characters of differentiation, as the following tables show.

P. celastroides.

Erect divaricate branched shrubs, 1-3 feet in diameter.

Leaves obovate to elliptical, penninerved, darker on the upper surface, 1-2½ inches long.

Petioles very short, compressed.

Cymes 1-1½ in. long, bearing 6-18 flowers.

Pedicels short, minutely pubescent.

Anthers elliptical, smaller than *P. eucalyptifolius*.

Fruit 7-11 mm. long, pale pink or reddish on one side.

First pair of leaves elliptical.

Rarely parasitic on the Eucalypti.

Distribution strictly coastal.

P. eucalyptifolius.

Pendulous shrubs, branches 1-10 feet long, 1-4 ft. in diameter.

Leaves oblong to broad lanceolate, triplinerved, light green on both surfaces, 1-10 inches long.

Petioles curved, terete, ½-1½ cm. long.

Cymes 1-4 ins long, bearing 12-24 flowers.

Pedicels rather long, glabrous.

Anthers oblong.

Fruit 8-15 mm. long, yellowish, or green with a yellow top.

First pair of leaves lanceolate.

Common on the Eucalypti.

Distribution coastal, and beyond the coast range.

Synonyms.—*Loranthus eucalyptifolius* Sieb., *Loranthus eucalyptioides* DC., *Endorhaphthoe eucalyptioides* (Sieb.) Ettingshausen.

Range.—This species is exceedingly common along the East coast, from Victoria to southern Queensland; in the latter State it has been collected at a few places only. No doubt, if a thorough search were made, it would be found to be nearly as common in the northern State as in New South Wales, where it is a menace not only to the native vegetation, but to the exotic flora as well, especially fruit trees.

From my own observations, and from data culled from various sources, this species has a greater range of food plants than any other. Incidentally I might mention that as regards its choice of host plants, *Eucalyptus* seems to be one of its special favourites; while *P. celastroides*, which is almost as common in the Port Jackson District, has only been found once on *Eucalyptus* by me.

Victoria: Studley Park, near Melbourne (F. M. Reader, 6-3-1885, in Melbourne Herbarium); Yarra (F. Mueller, quoted by Bentham, B.Fl., iii., 389); Austral felix, Central Victoria (Mitchell. This is probably the specimen referred to by Bentham, *l.c.* The leaves are broad spatulate to narrow lanceolate, acuminate, obscurely nerved. This and the two preceding specimens were kindly lent by Professor Ewart of Melbourne Herbarium); Hawkesdale (H. B. Williamson, No. 169); Langwarrin to Frankston (Parasitic on the following plants: *Acacia armata* R.Br., *Casuarina suberosa* Ott. and Diet., *C. stricta* Ait., *Crataegus* sp., *Eucalyptus radiata* Sieb., *E. ovata* Labill., and *E. cinerea*. On some of the plants the larvae of the Mistletoe Butterfly, *Delias harpalycce* Don, were observed, while some were pupating. See T. S. Hart in Vict. Nat., xxxiv., 1917, 32).

New South Wales: Bermagui, on *Eucalyptus Sieberiana* and *Acacia decurrens*. (W. Dunn); Temora, on *Eucalyptus hemiphloia*, var. *albens*, (Bishop Dwyer, No. 157 and 981. This is the most distant inland locality for this species, 296 miles from Sydney and about 200 miles from the coast. The specimen does not differ in any way from the Port Jackson types.); Nerriga (J. L. Boorman); Wollondilly and Wombeyan Caves, on *Brachychiton populneus* (E. Cheel and Dr. J. B. Cleland); Nowra, on *Eucalyptus* sp. (W. Bauerlen); Bowral, on *Eucalyptus viminalis* (R. H. Cambage, These Proceedings, xxxi., 1906, 439);

Hill Top, on *Eucalyptus haemastoma* (E. Cheel); Mt. Kembla, on *Eucalyptus longifolia* and other Eucalypts (A. G. Hamilton, These Proceedings, xxx., 1905, 490, as *L. celastroides*); Wollongong (Asa Gray, l.c.); Pictou, on *Eucalyptus amplifolia* (Dr. E. C. Chisholm); Camden, on *Eucalyptus crebra* (Dr. E. C. Chisholm); Cabramatta to George's River, on the following hosts—*Eucalyptus sideroxylon*, *E. Parramattensis*, *E. siderophloia*, *E. longifolia*; with short broad lanceolate to broad spatulate, triplinerved leaves, *E. amplifolia*, *E. tereticornis*. Leaves broad, 3- to 5-nerved, bank of George's River. Leaves thick, broad lanceolate, almost nerveless, on *Angophora intermedia*, a short leaved form (W.F.B*, D.W.C.S. and H. Bott); Canley Vale, on *Eucalyptus siderophloia*, *E. hemiphloia* (same collectors); Fairfield, on *Eucalyptus tereticornis*, *E. amplifolia*, and *E. sideroxylon* (same collectors as preceding); Como (E. Betche); Tom Ugly's Point (J. H. Camfield); Hurstville, on *Eucalyptus* sp., *Casuarina* sp., and on *Angophora intermedia* (J. H. Camfield); on *Eucalyptus acmenioides* (W.F.B.); Carlton, on *Casuarina suberosa* (J. H. Camfield); Carr's paddock, Carlton, on the following hosts: *Eucalyptus punctata*, *Angophora lanceolata*, *Casuarina suberosa*, *Exocarpus cupressiformis* (W.F.B.); Botany Bay (J. H. Camfield); Sydney (B. Bynoe); Garden Palace Grounds, Sydney (J. H. Camfield); on *Platanus orientalis* (J. Murphy); Botanic Gardens, Sydney, on *Eucalyptus tereticornis*, with short broad leaves; on *Quercus bicolor*; leaves broad lanceolate, 1½ to 3 inches long, very thick; on *Quercus lusitania*, *Quercus alba*, *Juglans cinerea*, *Eucalyptus viminalis*, *E. ficifolia*, *Platanus orientalis*, *Carya olivaeformis*, *Eucalyptus Watsoniana*, *E. ochrophloia* and *E. melanophloia*. Two examples of double parasitism, (1) showing self-parasitism and (2) parasitism on *Phrygilanthus celastroides* (W.F.B.); on *Cytisus proliferus* (J. Driver); Lady Macquarie's Chair, on *Eucalyptus resinifera* (J. H. Camfield); Neilsen Park, Vancluse, on *Eucalyptus haemastoma*, leaves linear-lanceolate, acute, obscurely 3-nerved; also on *Casuarina suberosa*, with short broad leaves (W.F.B.); Willoughby, on *Eucalyptus Sieberiana* (D.W.C.S. and H. Bott); The Spit, on the following hosts: *Casuarina suberosa*, *Eucalyptus punctata*, *E. piperita*, Pear Tree, (W.F.B. and J.L.B.); between 7-8 mile post, Gordon-Pittwater Road, on *Eucalyptus capitellata*, and *E. eugenioides* (W.F.B. and D.W.C.S.); Meadowbank, on the following hosts: *Eucalyptus tereticornis*, *E. eugenioides*, *E. amplifolia*, *Angophora intermedia*, *Melaleuca parviflora*, *M. lineariifolia*, *Acacia decurrens* var. *mollis* (W.F.B.); Ermington Park, on *Melaleuca styphelioides*, *Eucalyptus crebra*, and on *E. amplifolia* (W.F.B. and D.W.C.S.); Rydalmere, on the following hosts: *Eucalyptus longifolia*, *E. paniculata*, *E. acmenioides*, *E. punctata*, *E. siderophloia*, and *E. resinifera* (W. F. Blakely and D.W.C.S.); Parramatta River, Parramatta, on *Callistemon salignus* (W.F.B. and D.W.C.S.); Homebush Road, Homebush, on *Eucalyptus longifolia* (E. Cheel); Blacktown (R. H. Lalor); Glenbrook, on *Eucalyptus notabilis* (J.L.B.); Mt. Wilson (A. G. Hamilton, These Proceedings, xxiv., 1899, 359); on *Eucalyptus viminalis* (J. Gregson); Jenolan Caves, on *Eucalyptus punctata*—The only specimen noted in the district of this species, whereas *Loranthus pendulus* is very common (W.F.B.); Rylstone and Goll River District, in fruit (R. T. Baker, These Proceedings, xxi., 1896, 452)—A distant locality for the species (W.F.B.); Mudgee district (A. G. Hamilton, These Proceedings, xii., 1887, 282)—this is also a distant locality for this coastal plant (W.F.B.); Lindfield, on the following hosts, *Eucalyptus eugenioides*, *E. paniculata*, *E. saligna*, *Angophora lanceolata*, *A. intermedia*,

* Abbreviations: W.F.B. = W. F. Blakely, D.W.C.S. = D. W. C. Shires, J.L.B. = J. L. Boorman.

Casuarina suberosa (W.F.B.); Killara, on *Eucalyptus resinifera*.—The host is badly infested with the parasite, the young plants have narrow lanceolate leaves, the old ones broad lanceolate leaves; on *Crataegus oxycantha*, *Prunus Lauro-cerasus*, and on *Quercus pedunculata* (W.F.B. and D.W.C.S.); Gordon, near Station, on *Eucalyptus saligna*, and also on a Pear tree (W.F.B.); St. Ives, on the following hosts: *Eucalyptus paniculata*, *Photinia serrulata*, *Angophora Bakeri*, *A. lanceolata*, *A. intermedia*, *Acacia decurrens* var. *pauciglandulosa*, also *Loranthus vitellinus* (W.F.B., D.W.C.S. and H. Bott); Pymble, on the following hosts: *Acacia decurrens* var. *mollis*, *Casuarina suberosa*, *Angophora intermedia*, flowers $2\frac{1}{4}$ in. long, on Peach Tree, *Acacia floribunda*, *Eucalyptus saligna*, *E. paniculata*, *E. pilularis*, leaves broad lanceolate, triplinerved (W.F.B.); Pennant Hills, on *Schinus molle*, showing example of self-parasitism, and double parasitism with *Loranthus vitellinus*, on *Quercus pedunculata* (T. Steel); Turramurra, on *Acacia decurrens* var. *mollis*, *A. implexa*, and on *Eucalyptus saligna*.—On the latter host it is very often suspended from the trunk of the tree (W.F.B.); Warrawee, on *Platanus orientalis*, showing examples of double parasitism with *Phrygilanthus celastroides*, and vice versa—One of the young plants of the latter had alternate leaves, which appeared to be quite natural; on *Angophora intermedia*, Plum tree, also on a Cherry tree, and *Salix Babylonica* (W.F.B.); Normanhurst, on the following hosts: *Eucalyptus saligna*, *E. pilularis*, *E. eugenioides*, *E. resinifera*, *E. paniculata*.—The two latter are almost identical with No. 33, from Wallangarra; on *E. piperita*, *Casuarina torulosa*, *C. suberosa*, leaves linear, lanceolate; on *Angophora lanceolata*, leaves all narrow lanceolate, mostly under 2 ins. long; on *A. intermedia*, leaves broad lanceolate, 2 to 5 inches long, $\frac{1}{2}$ to 1 inch broad; on *Cytisus proliferus* var. *palmensis*, in company with *Loranthus vitellinus*, an unusual host (W.F.B. and D.W.C.S.); Pennant Hills Road between Wahroonga and Normanhurst, on the following hosts: *Euonymus japonicus*, *Magnolia grandiflora*, showing examples of secondary parasitism, and also double parasitism with *Phrygilanthus celastroides*; on *Melia Azedarach*, *Photinia serrulata*, *Acacia implexa*, *Tristania conferta*, and *Erythrina indica* (W.F.B.); Wahroonga, on the following hosts: *Viburnum odoratissimum*, *Laurus nobilis*, *Acacia Baileyana*; Waitara, on *Acacia prominens*, *Acacia decurrens* var. *mollis*, leaves broad lanceolate to broad spatulate, the largest 3 inches by $1\frac{3}{4}$ inches, 3- to 5-nerved (W.F.B.); Hornsby, parasitic on the following hosts, *Eucalyptus eugenioides*, *E. piperita*, *E. paniculata*, *E. haemastoma*, *Casuarina suberosa*, branches 5 feet long, leaves acuminate, triplinerved; on *Angophora cordifolia*,—the host was almost dead, but the parasite was strong and healthy and measured 5 feet long, and 3 feet in diameter, with leaves 2 to 6 inches long; on *Leptospermum stellatum*, *Callistemon lanceolatus*, with flowers 18 to 24 in the cyme; on *Platanus orientalis*, and *Acacia linifolia* (W.F.B.); on track to Gibberagong Creek, 3 miles east of Hornsby, on *Eucalyptus Sieberiana*, *E. piperita*, *E. haemastoma* var. *micrantha* (W.F.B.); Asquith, on the following hosts: *Eucalyptus resinifera*, *E. paniculata*, *E. eugenioides*, *Exocarpus cupressiformis*,—on the latter, the plant was about 18 inches long, but the adventitious roots were 7 feet long; on Peach tree, Plum tree, and on *Leptospermum attenuatum* (W.F.B.); Galston Road, near $16\frac{1}{2}$ mile post, on *Eucalyptus haemastoma*, growing from the trunk of the tree, about two feet from the ground (W.F.B. and D.W.C.S.); Galston Valley, on the following hosts: *Eucalyptus eximia*, and *Angophora Bakeri* (W.F.B. and D.W.C.S.); Mt. Colah, on Pear tree and on *Angophora lanceolata* (W.F.B., D.W.C.S. and H. Bott); 2 mile post, Kuringgai Chase Road, E. of Mt. Colah, on *Eucalyptus squamosa* (same collectors as

preceding); Trig Ridge, 1 mile N.W. of Mt. Colah station, on *Eucalyptus squamosa*, with young plants parasitic on the parent plant (W.F.B. and D.W.C.S.); Bobbin Head, Kuring-gai Chase, on *Eucalyptus punctata* (W.F.B.); near Kuring-gai Station, on *Casuarina suberosa*, (D.W.C.S. and T. Steel); Berowra Creek, foot of Crosslands Track, on *Angophora lanceolata* and on *Casuarina suberosa* (W.F.B. and D.W.C.S.); Berowra, near Station, on *Eucalyptus eugenioides*; Berowra Creek, Berowra, on the following hosts: *Eucalyptus piperita*, *E. haemastoma*, *E. punctata*, leaves like the Wallangarra specimen; on *Casuarina suberosa*, with short broad leaves; on *C. torulosa*, with linear to broad lanceolate leaves; on *Angophora intermedia*, and *A. lanceolata* (W.F.B.); near Cowan Station, on *Eucalyptus eugenioides* (W.F.B. and D.W.C.S.); Cowan Creek, Cowan, on *Eucalyptus squamosa*, *E. haemastoma*, *Casuarina suberosa*, and *Eucalyptus punctata* (W.F.B., D.W.C.S., and H. Bott); Hawkesbury River, near Brooklyn, on the following hosts: *Angophora lanceolata*, *Eucalyptus piperita*, *E. punctata*, *E. corymbosa*, No. 26, *E. umbra*, *Casuarina suberosa*, and *Exocarpus cupressiformis* (W.F.B. and D.W.C.S.)—It was also parasitic on *Loranthus Miquelii* and on *L. vitellinus*, the former on *Eucalyptus citriodora* and the latter on No. 26; Gosford, on *Angophora intermedia* (W. A. W. de Beuzeville); Belmont, Lake Macquarie, on *Casuarina glauca*, No. 1061, and also parasitic on *Loranthus Exocarpi* var. (a), No. 1062 (Bishop Dwyer); Hunter River District (A. C. Barwick, These Proceedings, xxviii., 1903, 940); Wallangarra, on *Eucalyptus Bancrofti*, No. 33, leaves narrow to broad lanceolate, triplinerved, 3 to 8 inches long; also on *Eucalyptus sideroxyylon* (J.L.B.).

Queensland: Main Range, Highfields (F. M. Bailey, in Queensland Herbarium)—This specimen is identical with No. 33 from Wallangarra; Bunya Mountains, No. 1 on *Acacia decurrens* var. *pauciglandulosa*, No. 2 on *Exocarpus cupressiformis*, No. 3 on *Eucalyptus* species (C. T. White, Oct., 1919). Also recorded by C. T. White (Queensland Agricultural Journal, xiii., 1920, 30) as *Loranthus eucalyptifolius* Sieb. (I take the responsibility for the nomenclature). Bay of Inlets; Thirsty Sound (Banks and Solander, 1770) mixed with specimens of *Loranthus longiflorus* (= *L. vitellinus*). Ex Herbario Musei Britannici. This locality is doubtful.

Hosts.—Juglandaceae: *Carya olivaeformis* Nutt., *Juglans cinerea* L. Betulaceae: *Quercus bicolor* Willd., *Q. pedunculata* L., *Q. alba* L., *Q. lusitanica* Lam. Casuarineae: *Casuarina suberosa* Ott. and Dietr., *C. glauca* Sieb., *C. stricta* Ait. Salicaceae: *Salix babylonica* L. Loranthaceae: *Loranthus pendulus* Sieb., *L. vitellinus* F. v. M., *L. Exocarpi* Behr. var. (a), *L. Miquelii* Lehm., *Phrygilanthus celastroides*. Santalaceae: *Exocarpus cupressiformis* Labill. Magnoliaceae: *Magnolia grandiflora* L. Lauraceae: *Laurus nobilis* L. Platanaceae: *Platanus orientalis* L. Rosaceae: *Crataegus oxyacantha* L., *Prunus Lauro-cerasus* L., *Photinia serrulata* Lindl., Plum, Peach, Quince, Pear. Leguminosae: *Acacia adunca* A. Cunn., *A. armata* R. Br., *A. Baileyana* F. v. M., *A. decurrens* Willd. var. *mollis* Benth., *A. decurrens* Willd. var. *pauciglandulosa* F. v. M., *A. floribunda* Willd., *A. implexa* Benth., *A. linifolia* Willd., *A. prominens* A. Cunn., *Cytisus proliferus* L. var. *palmensis*, *Erythrina indica* L. Meliaceae: *Melia Azaderach* L. var. *australasica*. Celastraceae: *Euonymus japonicus* Thunb. Sterculiaceae: *Brachychiton populneus* R. Br. Myrtaceae: *Tristania conferta* R. Br., *Angophora Bakeri* Hall, *A. cordifolia* Cav., *A. lanceolata* Cav., *A. intermedia* DC., *Callistemon lanceolatus* DC., *C. viminalis* Cheel, *C. salignus* DC., *Leptospermum attenuatum* Sm., *L. flavescens* Sm., *L. stellulatum* Sm., *Eucalyptus acmenoides* Schau., *E. amplifolia* Naudin., *E. Baueri* Naudin.

F. v. M., *E. Bancrofti* Maiden, *E. capitellata* Sm., *E. cinerea* F. v. M., *E. corymbosa* Sm., *E. crebra* F. v. M., *E. eugenoides* Sieb., *E. eximia* Schau., *E. ficifolia* F. v. M., *E. haemastoma* Sm., *E. haemastoma* Sm. var. *micrantha* Bth., *E. hemiphloia* F. v. M., *E. longifolia* Link et Otto., *E. melanophloia* F. v. M., *E. Muellieri* Naudin., *E. notabilis* Maiden, *E. ochrophloia* F. v. M., *E. ovata* Labill., *E. paniculata* Sm., *E. Parramattensis* Hall, *E. pilularis* Sm., *E. piperita* Sm., *E. punctata* DC., *E. radiata* Sieber, *E. resinifera* Sm., *E. saligna* Sm., *E. siderophloia* Benth., *E. sideroxylon* A. Cunn., *E. Sieberiana* F. v. M., *E. squamosa* Deane and Maiden, *E. tereticornis* Sm., *E. umbra* R. T. Baker, *E. viminalis* Labill., *E. Watsoniana* F. v. M. Caprifoliaceae: *Viburnum odoratissimum* L.

2. PHERYLANTHUS CELASTROIDES (Sieb.) Eichl. (Plate xxx.).

Eichl., Fl. Bras., v., 1868, 48; Engl. and Prantl, Nat. Pflanzenfam., iii., 179; Sieb. in Roem. and Schult., Syst. Veg., vii., 1829, 163, as *Loranthus celastroides*; De Candolle, Prod. Syst. Veg., iv., 1830, 318; Bauer's drawings, Aust. Plants, 145; A. Gray, Bot. Wilkes Expl. Exped., i., 1854, 740, t. 100; F. Mueller, Pl. Vic., Fig. on left hand side of Plate 30; Benth., B. Fl., iii., 1866, 389; Mueller, Key Vic. Fl., Fig. on upper side of tab. 66, Part ii., vide also Part i., 1887-88, p. 273 (in part); Ewart, Weeds Viet., after p. 28, Fig. on left hand side of plate; Bailey, Qland Fl., v., 1377; Ettingshausen, Über Die Blatts., Tab. i., Fig. 7-9.

I have not seen the original description; those of De Candolle and Dr. A. Gray, in the above works are much the same. I, however, give the latter preference, as he has gone to great pains in drawing up a very clear description. I therefore quote him in full:

"L. glaber; ramis teretibus; foliis oppositis obovato-oblongis seu ellipticis basi attenuatis breviter petiolatis obtusissimis fere aveniis; pedunculis axillaribus vel ramulos breves bifoliatis desinentibus brevibus cymulifloris; floribus breviter pedicellatis pentameris unibraeteolatis; antheris ovali-oblongis dorso-fixis versatilibus.

"The specimens bear flowers, which have not before been described. The plant is *glabrous*, except an extremely minute pubescence on the peduncles and nascent parts. *Branches terete*, nodose. *Leaves opposite*, obovate, oblong, or elliptical, with a *narrowed base*, contracted into a very short petiole, $1\frac{1}{2}$ to 2 inches long, *very obtuse*, dull, thick and fleshy-coriaceous in texture, *nearly veinless*, even the midrib inconspicuous except towards the base. *Peduncles axillary*, or more commonly *terminating short and two-leaved axillary branchlets*, 2 to 5 lines long, *cymosely several-flowered*. *Flowers in threes*, the *lateral short-pedicelled*, the intermediate one sessile, or sometimes all pedicelled,* each subtended by a small ovate bractlet, recurved, *pentamerous*. Ovary ovoid. Calyx-tube short, coroniform, truncate, puberulent on the edge, which is entire or obscurely denticulate, at length sometimes 4-5-toothed or lobed. Corolla apparently red or purple, an inch and a quarter in length, curved in bud, and the apex clavate-thickened; the slender petals connivent into a tube, but separating after anthesis. Filaments free down almost to the middle: *anthers oval*, or *short-oblong*, emarginate at both ends, *fixed by the middle, versatile*. Style filiform, as long as the stamens: stigma minute, subcapitate. Fruit not seen."

*I have not been able to confirm this statement. In the large amount of material examined by me, the central flower is always sessile.

Supplementary notes.—*P. celastroides* always forms round, compact shrubs, 1-3 feet in diameter. Branches short divaricate. Union often obscured by matted adventitious roots, causing irregular swellings on the host; sometimes the main attachment is enlarged to a diameter of 2-4 inches on very old plants; the adventitious roots are shorter than those of *P. eucalyptoides* and are more firmly attached to the host, very rarely free as in that species. Leaves mostly oblong elliptical, 1-nerved with numerous fine parallel veins at an angle of about 45 degrees, with reticulate veins between them. Cymes minutely pubescent on the pedicels and bracts, bearing 6-18 flowers, nearly all pendulous, but often crossing each other owing to the curved calyx. Buds 3-4 cm. long, sea-green underneath, shading on the upper surface from a deep rose pink, plate 120, to carmine-red, No. 1, plate 114 (Rep. de Col., Dautheyay). Petals about the same colour inside. Free portion of the filaments dark violet, No. 2-4 plate 193 (Rep. de Col.), the adnate portion carmine-red, the upper filaments the longest, with a small solitary gland on the geniculate portion close to the anthers. Anthers yellow, elliptical, 1 mm. long, opening before the flower expands, smaller than those of *P. eucalyptifolius*. Style curved in bud, exceeding the stamens when the flower opens. Stigma small, often minutely bi-lobed. Fruit usually pear-shaped, 7-11 mm. long, 4-6 mm. in diameter, very smooth and glossy, turning a strawberry red, especially on the upper surface, ripening somewhat later than *P. eucalyptifolius*, without the yellow top of that species, and usually free from any depression at the top, but marked by two slightly-raised rings surrounding the angular disc, which is also more or less conspicuous. Endocarp thick and leathery; viscin sac 5-8 mm. long, the spongy base very small and globose; seed turbinate, somewhat angular at the top, 3-4 mm. long; endosperm white, embryo clavate, 2 mm. long; embryonic cotyledons spatulate, remaining in the endosperm when germination takes place; hypocotyl very short, about 1 mm. long, disc broad. Primary leaves broadly ovate to spatulate 5 mm. long.

Synonyms.—*Loranthus celastroides* Sieber, *Loranthus maytenifolius* A. Gray (in Wilkes, Expl. Exped., p. 739, plate 99, in part), *Dendrophthoe celastroides* Mart. (vide Ettingshausen in *Über die Blatt. der Loranth.*, p. 20, Taf. ix., Figs. 7-9).

G. Don (Gen. Hist., iii., 432) places *Loranthus celastroides* Sieber, No. 244, with *Nuytsia floribunda* R. Br., probably on account of the versatile anthers.

Port Jackson, in the vicinity of Sydney, is probably the type locality of this species. It is evident that Sieber obtained his specimens close to Sydney in 1825, where it is still very common, especially along the coast. It rarely extends more than ten miles beyond the salt water limit of the tidal creeks and rivers.

This species has a decided dislike for *Eucalyptus* and *Acacia*. After a thorough search over a large area, and investigations of the specimens in the National Herbarium, I have only found one example of this species living upon a *Eucalyptus*. It is frequently found parasitic upon *P. eucalyptifolius* and vice versa, and in all cases observed, both species maintained their own individuality; I cannot find one example where these two species, *P. celastroides* and *P. eucalyptifolius*, pass into each other or show any signs of mimicry, even when living on each other.

Examples of double parasitism of these species may possibly have given rise to the idea that they were one and the same plant, as it is frequently met with in the field. For instance *P. celastroides* and *P. eucalyptifolius* gave examples of double parasitism on the Eastern Plane, *Platanus orientalis*, and

also on a species of *Pyrus*,* at Warrawee, Sydney, and had confined themselves to separate branches on the same tree. Another example in the same locality was that of *Eucalyptus paniculata* Sm. acting as host for *P. eucalyptifolius*, which in turn became the host of *P. celastroides*. It is noteworthy that when these two species unite, the union in many cases is scarcely noticeable, and it is no wonder that confusion has arisen owing to the mistaken identity of these two plants, so closely related and having much in common with one another. A little study and closer observation of the habit and general appearance of both in the field will enable one to separate or distinguish them at a glance.

Its chief food-plants are *Banksia serrata*, *B. integrifolia* and *Casuarina suberosa*. In the neighbourhood of Bondi, *Nerium*, amongst the exotic genera, is a very common host, and a little further inland *Platanus orientalis* is a favourite food-plant of this species. It is a common sight to see trees of the Eastern Plane green with the parasite in winter, or in exposed situations the leaves are often a pale purple brown.

Range.—*South Australia*: Professor Tate (Trans. Roy. Soc. S. Aust., iii., 1879-80, 68, and also Handbook Flora Extra Tropical S.A., 1890, 106) records this species for South Australia, but I have not seen a specimen from that State. Professor Oshorn, of the Adelaide University Herbarium, also informs me that it is not represented in that Herbarium.

Victoria: Snowy River (Flowers pink, E. E. Pescott, No. 175, per Chas. Walter, Feb., 1901); Mentone, on *Schinus molle* L. ("Said to be the first record in Victoria of the parasite growing on it; also that there were no Mistletoes within a radius of 2 or 3 miles, so the seed must have been carried some distance by birds," J. R. Tovey, Viet. Nat., xxxi., 154); Brighton, on British Oak, *Q. robur* L. (Miss O. B. Davis, Viet. Nat., xxvi., 177); Seorsby, on *Casuarina suberosa* and *Acacia armata* R. Br. (T. S. Hart, Viet. Nat., xxxiv., 32-33); Lake King (in Herb. Melbourne, labelled *L. eucalyptoides* DC. var., F. Mueller; quoted by Bentham, B. Fl.); Yarra (F. Mueller, B. Fl.); Grampians (D. Sullivan, Aust. Assoc. Adv. Sc., ii., 1890, 509); Greenvale (C. S. Sutton, Viet. Nat., xxxiii., 136); Barry's Hill, Wilson's Promontory (Ewart, Viet. Nat., xxvi., 131); Victorian Alps (Ewart, Viet. Nat., xxvii., 112); North West Victoria (St. Eloy D'Alton, Aust. Assoc. Adv. Sc., vii., 465).

New South Wales: Twofold Bay (B. Fl., l.c.); Narrawallee (R. H. Cabbage, No. 3501. The flowers are in sessile clusters of three at the end of the pedicel as in L. No. 18 [W.F.B.]); Milton, on *Banksia integrifolia* L. (R. H. Cabbage, No. 4061); Sussex Inlet Heads, on *Banksia integrifolia*, and *Eugenia Smithii* (J. H. Maiden; the leaves are small, broadly spatulate to elliptical and almost identical with the Bondi specimens [W.F.B.]); Mount Kembla, on *Psychotria loniceroides*, *Persoonia salicina*, *Elaeodendron australe*, *Comersonia Fraseri* (A. G. Hamilton, These Proceedings, xxx., 490); Wollongong (Dr. A. Gray, l.c.); Cronulla, on *Banksia integrifolia* (E. Cheel); Shipwright's Bay, George's River, on *Banksia integrifolia* (J. H. Camfield); Carr's paddock, Carlton, on *Banksia serrata*, and also parasitic on *Callistemon lanceolatus* (W.F.B.); Kurnell Bay (J.L.B.); Port Jackson (E. Betehe); Farm Cove, Outer Domain (J. H. Camfield, Annual Report Botanic Gardens, 1902, 30); Botanic Gardens, on *Nerium Oleander* (R. Mitchell); on *Quercus alba*, *Q. Lusitanica*, and *Platanus orientalis* (W.F.B.); on *Phrygilanthus eucalyptifolius* and also parasitic on *Eucalyptus tereticornis* (A. Stanley and G. Rollinson); on *Quercus virens* (R. Mitchell); Double Bay, on *Banksia* sp. and *Robinia Pseudo-Acacia* (Dr. J. MacPherson); Bondi sand-hills, on *Banksia serrata* (Leaves

rather small, spathulate, W.F.B.); Neilsen Park, Vacluse, on *Banksia integrifolia*, *Casuarina suberosa*, *Phrygilanthus eucalyptifolius* which was parasitic on *Eucalyptus haemastoma* (W.F.B.); Lavender Bay, on Pear tree (W.F.B.); Berry's Bay, on *Robinia Pseudo-Acacia* (W.F.B.); Wollstonecraft, on *Schinus molle* (W.F.B.); Sirius Cove, on *Banksia integrifolia* (Dr. J. B. Cleland); The Spit, on *Casuarina suberosa* Ott. & Diet., also on Pear tree (W.F.B. and J.L.B.); Curl-Curl (H. Deane, Jan., 1884); on *Banksia integrifolia* (E. Ellen); the neighbouring portions of the contiguous Boroughs of Hunter's Hill, Lane Cove and Ryde, parasitic on 37 hosts, vide J. J. Fletcher, These Proceedings, xxx., 488-89. *P. eucalyptifolius* is also included under this species; Field of Mars (H. Deane); Lindfield, on *Casuarina suberosa* and also parasitic on *Phrygilanthus eucalyptifolius* on the same host (W.F.B.); Gordon, near Station, on Pear tree (W.F.B.); Pymble, on the following hosts, *Casuarina suberosa*, *Loranthus congener*, the *Loranthus* on the same host, *Casuarina torulosa* and on *Schinus molle* (W.F.B.); St. Ives, on *Acacia decurrens* var. *pauciglandulosa*, *Melia Azedarach*, *Schinus molle*, *Magnolia grandiflora*, *Casuarina suberosa*, *Pyrus* sp. *Phrygilanthus eucalyptifolius*, which in turn was parasitic on *Angophora intermedia*. A clump of seed of this species containing seeds of *Notothixos subaureus* was also noticed on the *Acacia* (W.F.B., D.W.C.S. and H. Bott); Pennant Hills, on *Schinus molle*.—Flowers white, shading into very pale pink (T. Steel); Normanhurst, on *Casuarina suberosa*, *Syncarpia laurifolia*, *Casuarina torulosa*, *Photinia serrulata*, *Melia Azedarach*, *Prunus Persica*, *Phrygilanthus eucalyptifolius*, the latter on *Eucalyptus saligna* (W.F.B.); near Pearce's corner, Wahroonga, on *Magnolia grandiflora* (J. Sydenham).—Six months later I visited the same plant and noticed that cattle had eaten all the lower leaves and young branches of the parasite as high as they could reach [W.F.B.]; Warrawee, on *Platanus orientalis*, No. 10, *Prunus* sp., No. 197, also parasitic on *Phrygilanthus eucalyptifolius*, both on No. 10, and No. 197 (W.F.B.); Wahroonga, on *Schinus molle*, *Syncarpia laurifolia*, Apricot tree (W.F.B.); Waitara, on *Syncarpia laurifolia* (W.F.B.); The Valley, Hornsby, on *Phrygilanthus eucalyptifolius*.—The latter on *Angophora lanceolata* (W.F.B. and D.W.C.S.); Cockle Creek, Hornsby, on *Banksia serrata* (W.F.B.); Asquith, near the waterfall, on *Syncarpia laurifolia*, *Phrygilanthus eucalyptifolius*, the latter on *Eucalyptus piperita*, *Astrotricha floccosa*, *Hakea saligna* (W.F.B.); Gibberagong Creek, 4 miles east of Hornsby, on *Casuarina suberosa*, *Syncarpia laurifolia* (W.F.B.); Bobbin Head, Kuring-gai Chase, on *Casuarina torulosa*, *Loranthus vitellinus*, the *Loranthus* parasitic on *Angophora intermedia*, on *Loranthus congener*, the latter on *Casuarina suberosa* (W.F.B.); Junction of Berowra and Connelly's Creeks, on *Casuarina torulosa* (W.F.B.); Berowra Creek, Berowra, on *Loranthus vitellinus*, the latter on *Angophora Bakeri*, *Phrygilanthus eucalyptifolius*, the latter on *Angophora intermedia* (W.F.B.); Cowan Creek, near Windybank's, on *Synoum glandulosum* (W.F.B., D.W.C.S. and H. Bott); Cowan Creek, Cowan, on *Casuarina torulosa* (W.F.B. and D.W.C.S.); Hawkesbury River, Brooklyn, on *Eoecarpus cupressiformis* (W.F.B. and D.W.C.S.); Belmont, on *Banksia integrifolia* (Bishop Dwyer, No. 1070); Hastings River (Forester Brown); Macleay River, Crescent Head, on *Casuarina suberosa* (J. Sydenham); Coff's Harbour, on *Banksia integrifolia* and *Cupaniopsis anacardoides* (J.L.B.); Dorrigo (W. Heron); Dorrigo Forest Reserve,—On the summit of the Round Mountain, Gay Fawkes district (J. H. Maiden, Agric. Gaz., N.S.W., 1894, 615); Evans River, on *Aeronychia imperforata* (E. Betehe); Clarence River (Beckler, quoted by Bentham, B. Fl., 390, thus:—"In reference to Beckler's series of specimens from

Clarence River, several are quite intermediate as to the shape of the leaf." Beckler's specimens include more than one species [W.F.B.]); Mullumbimby (W. Bauerlen, No. 1519); Tweed River, on *Notothixos subaureus* Oliv. (W. Guilfoyle, 1871, in Melbourne Herbarium).

Queensland.—Maepherson Range, on *Casuarina* and *Persoonia* (C. T. White, Feb., 1912, recorded as *Loranthus maytenifolius* Gray); Brisbane River, Moreton Bay (quoted by Benthams, *l.c.*; F. M. Bailey and J. E. Tenison-Woods, These Proceedings, iv., 1879-80, 160); Noosa Heads, on *Banksia integrifolia* (C. T. White, No. 13,—The typical form; No. 14, with larger and thicker leaves); Burpengary (Dr. T. L. Bancroft, No. 178, 1901, in Queensland Herbarium, labelled *L. maytenifolius* Gray); Tambourine Mountain, on *Litsea reticulata* (Longman and White, Proc. Roy. Soc. Q'land, 29, 67, also Ex. Queensland Herbarium, No. 184, Feb., 1917).

Affinities.—Besides the close relationship of this species to *P. eucalyptifolius*, it bears a striking resemblance to *Loranthus alyxifolius* F.v.M., particularly in the shape and colour of the leaves, but the floral characters are totally different. *L.* No. 5, n.sp., is another species with leaves somewhat similar in shape, but differing considerably in venation. The same may be said of *L.* No. 9, n.sp. The anthers of these species are however basifixed, and when the flowers are available there is little chance of them being confused with *P. celastroides*.

Hosts.—Pinaceae: *Pinus insignis* (J. J. Fletcher, These Proceedings, xxx., 488-9). Casuarineae: *Casuarina torulosa* Ait., *C. suberosa* Ott. and Diet. Salicaceae: *Salix babylonica* L. Loranthaceae: *Notothixos subaureus* Oliv., *Loranthus vitellinus* F.v.M., *L. congener* Sieber, *Phrygilanthus eucalyptifolius* (Sieb.) Engler. Betulaceae: *Quercus robur* L., *Q. virens* Ait. Proteaceae: *Banksia serrata* L.f., *B. integrifolia* L.f., *Hakea saligna* R.Br., *Persoonia salicina* Pers. Magnoliaceae: *Magnolia grandiflora* L. Rosaceae: *Prunus Persica* L., *Pyrus* sp., *Crataegus oxyacantha* L. Lauraceae: *Litsea reticulata* Benth. Leguminosae: *Robinia Pseudo-Acacia* L. Platanaceae: *Platanus orientalis* L. Rutaceae: *Acronychia perforata* F.v.M. Meliaceae: *Synoum glandulosum* Juss. Sapindaceae: *Cupaniopsis anacardoides* Radt. Anacardiaceae: *Schinus molle* L. Celastraceae: *Elaeodendron australe* Vent. Sterculiaceae: *Commersonia Fraseri* J. Gray. Myrtaceae: *Angophora intermedia* DC., *Eucalyptus tereticornis* Sm., *Callistemon lanceolatus* DC., *Eugenia Smithii* Foir., *Syncarpia laurifolia* Ten. Araliaceae: *Astrotricha floccosa* DC. Apocynaceae: *Nerium Oleander*. Rubiaceae: *Psychotria loniceroides* Sieb.

3. PHRYGILANTHUS MYRTIFOLIUS (A. Cunn. Herb.) Eichl. (Plate xxxi.)

Eichl., Fl. Brazil, v., 1868, 48; Engler and Prantl, Pflanzenfam., iii., 197; Benthams, B. Fl., iii., 1866, 390, as *Loranthus myrtifolius*; Ettings., Über die Blatts., Tab. iii., Fig. 21 and 22; Bail., Queensland Fl., v., 1378, tab. 63.

Supplementary notes to the description in B. Fl., iii., 390.

It is usually a small plant with short, divaricate, brittle branches; union slightly swollen, surrounded by numerous slender adventitious roots, capable of clinging to small objects. Buds very slender, curved, as in all the allied species, and usually the same colour as *P. eucalyptifolius*. Filaments dark crimson; style green, shaded pink; stigma pink, very small. Fruit elliptical or oblong, pale pink. Cotyledons unknown.

Range.—The type comes from Logan Vale, Queensland, which is in the vicinity of Mt. Sturt, and Canning Downs, and was probably collected between

Freestone Creek and Killarney by Allan Cunningham in May, 1827. Since then it has been found in the following localities, which are not far from the spot where Cunningham first found it:—Gladfield (F. M. Bailey, 1890.—This locality is between Allora and Hendon, not far from the New South Wales border and is almost on the Macpherson Range); Killarney (Joe Webb, *vide* Bail., Qland. Fl., l.c.).

New South Wales: Acacia Creek, on *Lyonsia largiflorens* F. v. M. (W. Dunn, No. 259); Oakley Creek, Macpherson Range, on *Tecoma jasminoides* Lindl. (W. Dunn, No. 259a).

Affinity.—It is closely allied to *P. Bidwillii*, from which it differs in its sessile and broader leaves, which suggest the same variation between several species of *Loranthus* that have sessile cordate leaves and no essential difference in the flowers. This opens up the question as to the relationship existing between the sessile-leaved forms, and the narrow-leaved petiolate forms. In these two species which reproduce annually, they show marked differences in the leaves and are peculiarly constant in these characters which we are apt to treat lightly when they are not supported by floral or carpological characters. If we apply the same line of reasoning to other members of this family, we must also admit their broad-leaved allies as distinct individuals, since by the same natural process, they too are constant in these particular characters. I allude to *Loranthus pendulus* Sieb. var. *amplexifolius* Benth., *L. Quandang* Lindl. var. *amplexifolius* Benth., *L. longiflorus* Desr. var. *amplexifolius* (*L. amplexifolius* Bth., non DC.).

Hosts.—Apocynaceae: *Lyonsia largiflorens* F. v. M., Bignoniaceae: *Tecoma jasminoides* Lindl.

4. PHRYGILANTHUS BIDWILLII (Benth.) Eichl. (Plate xxxii.)

Eichl., Fl. Brazil, v., 1868, 48, Engl. and Frantl., Pflanzenfam., iii., 179; Benth., B. Fl., iii., 1866, 390 as *Loranthus Bidwillii*; Bail., Qland Fl., v., 1378, t. 62 as *L. Bidwillii* Bth.

Supplementary notes to the description in B. Fl., iii., 390.

This is a small growing species, rarely more than 1 ft. long, rather dense, with short jointed brittle branches; invariably parasitic on *Callitris*. Union club-like, developing short slender adventitious roots, which throw out supports beneath their lower surface almost at every inch, causing the host to gradually thicken, as in the case of the main attachment, and form new plants upon them. Flowers yellowish-green, shaded pink in the lower portion, reddish at the top. Buds slender, curved. Petals acute, the lowest exceeding the stamens by about 5 mm., the upper ones by about 2½ mm. Filaments dark red, compressed and somewhat furrowed, thickened at the point of attachment. Style bent in bud, exceeding the anthers by 2-3 mm. when the flower expands, green throughout; stigma rather small, reddish, capitate. Fruit broadly pear-shaped to globular, pink or bright red, 5 to 7 mm. long; epicarp very thin; endosperm white, turning green when germination takes place. Cotyledons obtuse, but not seen in a fully developed state.

This species, as far as my own observations go, is not a gross feeder nor a rapid grower, and it appears to be rather slow in the process of reproduction; whether this is due to its palatable fruits which are freely eaten by birds, or to the low germinating power of the seed remains to be proved.

Range.—The first record of the species is from Wide Bay, Queensland, B. Fl. l.c. The late Revd. B. Schorteechini (These Proceedings, viii., 1883, 251) has the following interesting note:—"Loranthus Bidwillii, Nerang Creek Heads, on the branches of *Callitris cupressiformis* Vent. The same mistletoe is more widely spread at Stanthorpe on the same kind of Pine, and at the mouth of the Mary, from which district the original specimen sent by Mr. Bidwill, whose name it bears, probably came." Through the kindness of Professor Ewart of Melbourne, I was able to see the Revd. Schorteechini's specimen, which does not differ from the following New South Wales specimens in the National Herbarium, Sydney.

New South Wales: Wallangarra (J. Staer); Baradine, on *Callitris robusta* (G. Burrow and J. B. Cleland, Botany of the Pilliga, p. 10, N.S.W. For. Dept., Bulletin No. 10, 1920); Forked Mountain, Coonabarabran, on *Callitris calcarata* R. Br. (Dr. H. I. Jensen); on White Pine, *C. robusta* (C. B. Meek); Pilliga, on *Callitris calcarata* (W. A. W. de Beuzeville); Warrumbungle Ranges (W. Forsyth); Narrabri, on *Casuarina Luehmanni* (R. T. Baker, These Proceedings, xxvii., 1902, 541); New England, on *Callitris* sp. (C. Stuart, No. 623, from Dr. Leichhardt's collection); Tamworth, on *Callitris calcarata* (W. M. Carne); Upper Moore Creek, Tamworth District, on *Callitris* sp. (Rev. H. M. R. Rupp); Owen's Gap, near Scone, on Cypress Pine (H. L. White); Mount Duri, Currabubula, on *Callitris robusta* (R. H. Cambage, No. 3549); Murrumbidgee, 50 miles north of Rylstone, on *Callitris* sp. (R. T. Baker, These Proceedings, ix., 1893, 732, also xxvii., 1902, 541); Cox's Gap, on *Callitris* sp. (R. T. Baker, *Id.*, xxi., 1896, 452); Bowan Park, near Cudal, on *Callitris calcarata*,—flowers pink; fruit globular, bright red (W.F.B.); Young, on Black Pine, *Callitris calcarata* (T. G. Sloane, vide J. J. Fletcher, These Proceedings, xxxiii., 1908, 291); Burren Jack, on *Callitris calcarata* R. Br. (E. Cheel, These Proceedings, xxxvii., 1912, p. 137, vide also Aust. Nat., 2, 135).

Affinity.—Differing from *P. myrtifolia* (A. Cunn.) Eichl. chiefly in its more erect habit and narrower leaves.

It is a summer flowering species, ranging from October to January.

Hosts.—Pinaceae: *Callitris calcarata* R. Br., *C. cupressiformis* Vent., *C. robusta* R. Br. Casuarineae: *Casuarina Luehmanni* R. T. Baker.

EXPLANATION OF PLATES XXVI.-XXXII.

Plate xxvii.

Nuytsia floribunda R. Br.

1. Portion of flowering branch; flowers slightly reduced. 2. A very common obtuse leaf, natural size. 3. A triad of buds. 4. Flower (after Lindley). 5. Anther. 6. Calyx and Style. 7. Portion of fruiting branch, natural size. 8. Fruit removed from bracts, natural size. 9. Seed, natural size. 10. Longitudinal section of seed showing position of the embryo. 10a. Cross section of seed. 11. Embryo showing 3 cotyledons. 12. A seedling (after Fletcher). 13. Parasitism of *Nuytsia* [A. Root of *Nuytsia*; B. Host: *C. cupressiformis*; C. Parasitic root of *Nuytsia*; D. Haustoriogen of parasitic root (after Herbert)]. 14. Longitudinal section of a Carrot showing the Haustoriogen (after Herbert).

Plate xxviii.

Gaiadendron ligustrina (A. Cunn.) Eichl.

1. Flowering branch, natural size. 2. Bud. 3. Flower on the bracteate pedicel. 4. One of the segments (after Hook.). 5. Anther (after Hook.). 6. Style. 7. Fruit, natural size. 7a. Embryo. 8. Longitudinal section of fruit. 9. Cross section of fruit (after Hook.), also the two preceding. 10. Stipules. 11. Cross section of root, natural size, (a) thick bark. 12. A seedling plant, natural size, showing the fibrous roots. 13. Types of floral bracts, after the fruits had fallen, natural size.

Plate xxix.

Phrygilanthus eucalyptifolius (Sieber) Engler.

1. Flowering branch, natural size. 1a. Anther. 2. A common type of deformed leaf. 3. Fruit, natural size. 4. Longitudinal section of fruit. 5. Cross section of fruit. 6. Longitudinal section of seed. 7. Germinating seed, natural size, with viscin removed. 8. Germinating seed showing two primary leaves. 9. Germinating seed surrounded with viscin. 10. A young plant, natural size, showing the two radicles (a, a), and the adventitious root (b.). 11. Section of host, *Casuarina suberosa*, natural size, showing the method of attack by the radicle which divides and infests the sapwood, causing a fusiform swelling. 12. Galled fruits, natural size, showing insect punctures. (4, 5, and 6 after Mueller.).

Plate xxx.

Phrygilanthus celastroides (Sieber) Eichl.

1. A flowering branch, natural size. 2. A bud. 3. Flower. 4. Anther. 5. Fruit. 6. Seed, enlarged. 7. Embryo. 8. Embryo opened out. 9. A germinating seed, natural size. 10. A germinating seed, natural size, with three primary leaves. 11. A young seedling plant showing the adventitious roots (a, a), and the alternate leaves (b, b). 12. Microscopic Fungus found on the viscin of the germinating seed.

Plate xxxi.

Phrygilanthus myrtifolius (A. Cunn.) Eichl.

1. Flowering branch, natural size. 2. A bud. 3. Flower. 4. One of the free filaments. 5. Anthers, front and back view. 6. Calyx and Style. 7. Fruit. 8. Disc. 9. Leaf, natural size, showing venation.

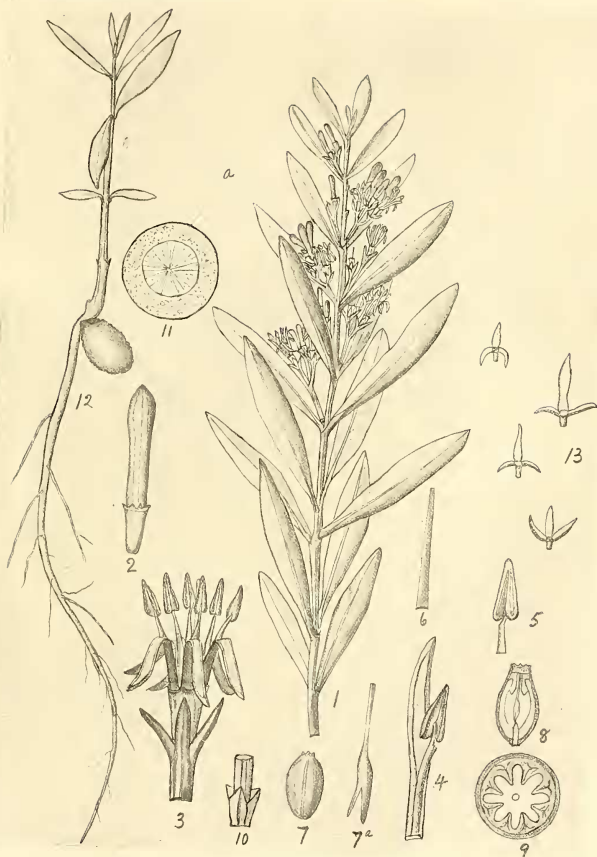
Plate xxxii.

Phrygilanthus Bidwillii (Benth.) Eichl.

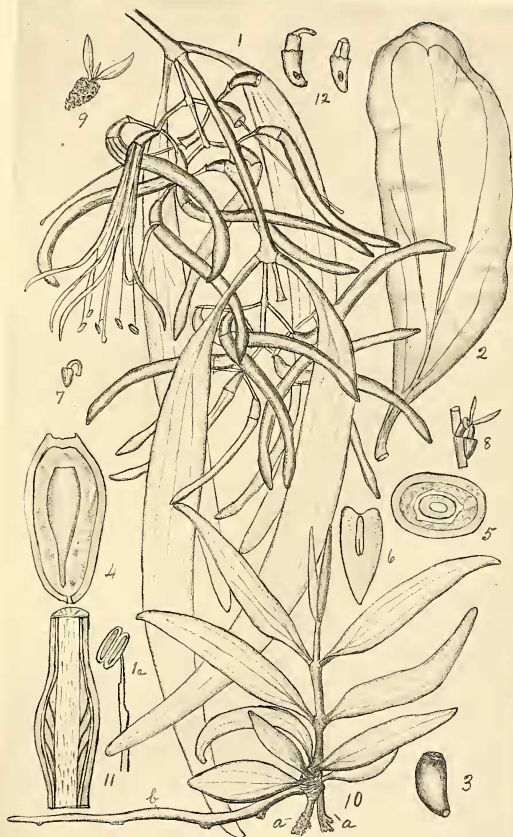
1. Flowering plant, natural size, showing union, and the fine adventitious roots. 2. Bud, enlarged. 3. Flower. 4. One of the free segments. 5. Anther. 6. Fruit, natural size.



Nuytsia floribunda R. Br.



Gaillardendron ligustrina (A.Cunn.) Eichl.



Phrygilanthus eucalyptifolius (Sieber) Engler.



Phrygilanthus celastroides (Sieber) Eichl.



Phrygilanthus myrtifolius (A.Cunn.) Eichl.



Phrygilanthus Bidwillii (Benth.) Eichl.